January 26, 2010

Ex Parte

Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, DC 20554

Re: GN Docket Nos. 09-47, 09-51, and 09-137

Dear Ms. Dortch:

On January 19, 2010, Ron Dicklin, the Chief Technology Officer of Root Wireless, and I met with Peter Bowen, Arnab Das, Julie Saulnier, Steven VanRoekel, Gray Brooks, Rebecca Hirselj, and Jordan Usdan of the Commission staff. We discussed issues associated with promoting transparency of mobile wireless networks and, more specifically, various technical and other issues that Root Wireless has faced in developing a means of observing, measuring, and reporting network performance. We also discussed the nature and means of providing such information to the public. Some issues that were discussed with the staff were also addressed by Root Wireless in comments (enclosed herewith) filed with the NTIA and RUS in connection with their proceeding regarding the Broadband Initiative Program and Broadband Technology Opportunities Program.

Out of an abundance of caution, this record of the meeting is being submitted into the record in the referenced dockets, and a copy is being transmitted electronically to each of the participants.

Please contact me at 206-734-9265 if you have any questions.

Sincerely,

Mark Bradner
Director of Government Affairs

Enclosure

cc: Peter Bowen
Arnab Das
Julie Saulnier
Steven VanRoekel
Gray Brooks
Rebecca Hirselj
Jordan Usdan

NATIONAL TELECOMMUNICATIONS INFORMATION ADMINISTRATION
AND
RURAL UTILITIES SERVICE

In the Matter of	)	
	)	
Broadband Initiative Program and Broadband Technology Opportunities Program	)	Docket No. 0907141137 - 01375-05
	)	
	)	
Implementing a Nationwide Broadband, Interoperable Public Safety Network in the 700 MHz Band	)	Rin 0660-7A 28

COMMENTS OF ROOT WIRELESS, INC.

Root Wireless, Inc. ("Root Wireless") hereby submits its comments in response to the Joint Request for Information ("RIF") in the captioned proceeding, released on November 16, 2009.[1]

I. INTRODUCTION

In the RIF, it was properly noted that the purpose of the expanded RUS broadband authority is to "improve access to broadband in rural areas without service or that lack sufficient access to high speed broadband service". 74 Fed. Reg. 58941. Similarly, the NTIA component of the broadband enhancement project was aimed at "deploying broadband infrastructure in unserved and underserved areas. . . ." Id. Critical to both the RUS and NTIA mission statements in this proceeding is an accurate understanding of where broadband, and in particular wireless

[1] The RIF was a joint product of the Rural Utilities Service ("RUS") and the National Telecommunications and Information Administration ("NTIA"). These entities requested that comments be filed by November 30, 2009. Hence, these comments are timely filed.

broadband, is available, and at what speeds. As discussed below, Root provides unique expertise on these critical issues.

The core issue of being able to accurately measure broadband availability also surfaces a number of times in the RIF itself. If, as suggested in the RIF (at 74 Fed. Reg. 58942), it is important to assure that federal funding has the greatest impact possible, it is essential to establish a proper baseline of availability that can be increased. The same applies to proposals to allocate portions of remaining funding to particular population groups (74 Fed. Reg. at 58943). The RIF's catch-all request for comments that will "enhance the programs and satisfy the goals of recovery" also replicate Root Wireless' core strength -- accurate measurement of wireless broadband availability.

II. ABOUT ROOT WIRELESS

Root Wireless is the developer of proprietary technology that audits and analyzes wireless network performance and displays the results in a variety of formats, including consumer-friendly maps. The company's products include Root Mobile™, a network scouting and crowd sourcing application that unobtrusively turns smartphones into network monitoring devices that measure the quality and reliability of cellular voice and data connectivity services, as well as the over-the-air performance of handsets connecting to the networks.

As the provider of a service that can be used to create and maintain detailed mapping data reflecting the availability of broadband wireless service and associated performance metrics, Root Wireless takes great interest in the efforts to establish standards by which such service will be measured. Root Wireless does not advocate any particular standard, but appreciates this opportunity to provide input on the questions posed by RUS and NTIA (the "Agencies").

III. ISSUES IN THE MEASUREMENT OF WIRELESS NETWORK PERFORMANCE

While certain basic standards of performance, such as throughput rates, can be applied to both wireless and landline broadband technologies, a number of factors result in much greater variability in the performance of wireless networks. These differences should be considered in order that standards can be established corresponding to the type of system being measured.

A. Advertised versus Actual Availability.

Carriers' marketing materials, which presumably are based on a combination of propagation models and actual observations, often portray, especially in urban markets, large areas that the carriers claim are covered in a contiguous manner. In fact, in addition to times when service may not be available because the network capacity has been exceeded in some manner, there often are spots within that claimed area of coverage in which a signal simply is not available.

In a recent study of eight metropolitan markets – Chicago, Dallas, Los Angeles, New York City, Orange County, Seattle/Tacoma, the San Francisco Bay Area, and Washington, DC – Root Wireless found that a 3G data connection could be obtained on approximately 94% of the attempts within those areas.[2] While we have not had an opportunity to compare these findings with the coverage areas claimed by these carriers, we suspect that the coverage maps shown by the carriers would indicate nearly universal coverage in these markets.

As another example, the maps attached as Exhibit A reflect the coverage of each of the four national carriers in a portion of the San Francisco Bay Area. The map on the right side of

[2] The study examined service provided by all four of the national carriers, AT&T, Sprint, T-Mobile, and Verizon. Results were based on the availability from each carrier of the service described by that carrier as its 3G service.

each page is that carrier's depiction of its coverage as taken from that carrier's website; the map on the left side reflects the results of testing by Root Wireless in the same area. The colored hexagons on the Root Wireless map indicate signal quality, with red indicating one or fewer bars and black indicating no signal.

Our point is not to criticize any of the carriers; there are numerous factors, starting with natural and man-made obstructions, that can restrict the propagation of a signal to a specific location. Our purpose is simply to note that the availability of service depends on the specific location of the end-user, so the area in which service is to be measured should itself be carefully defined and, perhaps, consideration should be given to including a measure of the availability of service within that area.

B. Advertised versus Observed Speeds.

Today, the technologies being used by the national wireless carriers have theoretical minimum download rates of anywhere between 220-600 kbps or more, although the carriers are careful to note that in their marketing materials that "speeds may vary" or some variation of that phrase. By Root Wireless's measurements in the eight markets that are listed above, the average download speed was 245 kilobytes per second[3]. This speed is only somewhat above the minimum low-end theoretical speed of all the technologies that have been deployed and is well below the download speed that has been established as the threshold in this proceeding for qualification as "broadband service".

Once again, this is not meant as a criticism of the wireless carriers, which have each spent billions of dollars to create networks capable of providing today's level of service. It is,

[3] Throughput rates were determined using off-the-shelf mobile devices and with methods otherwise designed to simulate the experience of actual end-users.

however, intended to point out that the speed actually experienced by members of the public can be dramatically different than the potential rates that are advertised by the carriers. The most fundamental question for the Agencies, in defining "broadband service", is whether throughput rates should be determined based on the rate that a network is capable of producing or if the rates should be those actually experienced by end-users.

C. Environmental Factors.

Unlike landline systems, which operate in relatively stable environments, wireless networks are affected by a host of variable environmental conditions, such as seasonal changes in vegetation, precipitation, and other weather conditions. Should measurements be taken without regard to these factors or should testing be designed to measure system performance under the most or least favorable conditions? Or perhaps to reflect the average of a range of conditions?

D. Variations Between Devices.

Differences between devices operating on wireless networks also will affect end-users' experience or perceptions of their experience. First, the performance characteristics of the components in the device that is connected to the wireless network – processor speed, operating system, and the like – can have dramatic differences on the speed experienced by an end user. For example, at the same location in the middle of an urban market, we measured the speed of two carriers' networks while using different 3G devices that each were sold for that carrier. The download and upload speeds on one device were roughly twice that of the other. While it is extremely difficult to isolate the variables that affect performance, both carriers provided a solid signal to that location, so the differences between devices constituted at least a major reason for the difference in the results. Second, no standard has been established for even the most basic

indications to an end user of the quality of the network connection they have established. Although the number of "bars" displayed on a phone has become generally recognized as the indicator of signal strength, there is no uniform standard that applies to device manufacturers in determining the number of bars corresponding to a particular level. We have routinely seen different devices, connected to the same network at the same location and receiving the same measured signal strength, that display anywhere between a 2 or even 3 bar difference.

Given the differences that can result from the use of different devices, the Agencies may wish to consider prescribing the type or class of device or other device-based standards that should be used when assessing the availability and quality of wireless service.

E. Data Management.

Different wireless technologies and different carriers utilize different protocols in managing data traffic on their networks. For example, with GSM/GPRS/EDGE/UMTS, separate channels are allocated for voice and data traffic so that voice and data traffic do not compete with each other for network access. With CDMA/EVDO, voice and data utilize the same channels, and voice traffic generally is assigned a higher priority. Therefore, as a network becomes more congested, data traffic, which is the avenue for broadband service, will be more impacted by congestion. In addition, some carriers have adopted policies to block or relegate usage by devices that are associated with data transmissions of relatively large size.

Transmission of large amounts of data may be seen as a fundamental element of broadband service. Therefore, in defining broadband service, the Agencies may want to consider the effect of excluding or limiting all or certain types of data or sources of transmission.

F. Network Traffic.

It is well-known that data speeds can be dramatically affected by the amount of traffic being carried on a wireless network at any given point in time. This effect becomes most pronounced as the demand on any individual element within a network, such as the system switch or the radios serving a particular sector of a cell site, nears the capacity of that element.

A special case of this behavior occurs when a less frequent event – such as a traffic jam or a sporting event or a convention – attracts a large number of people to a small area. The nearest cell site suddenly receives an influx of demands for service and, even if its capacity has been augmented in anticipation of a scheduled event, can quickly be overwhelmed.

In light of such variations, the Agencies should address whether the speed of the network be measured at a prescribed time of day or reflect an average speed at several different times? Or perhaps a combinations of the two, such as an average speed but subject to a minimum observed speed? Should special events be taken into consideration?

G. Network Modifications.

All wireless carriers are constantly modifying, retuning, and enhancing their networks. Occasionally, carriers implement more impactful actions, such as when they deploy a new generation of wireless technology. For the most part, these activities improve system performance, but these advances are not uniform. Sometimes improvements in the system overall are accompanied by a decline in performance in a particular area. Once again the question is whether network performance should be determined at the network or the end-user level and, beyond that, how dynamically or frequently performance should be assessed.

H. Technical Limitations.

Separate from the caps that some carriers impose on the amount of data that customers may receive or send, which usually are prescribed in the form of a monthly limit, other technical

factors may restrict the amount of data that can be transmitted on a mobile wireless network. In many instances, these limits involve the size of the data packet that is transmitted.

Each data transmission consists of one or more packets of data. A transmission may be as small as a few hundred kilobytes of data or as large as several megabytes. Different devices that are designed primarily to operate on a mobile wireless network have different standards for the size of the data packets transmitted by that particular device, but, based on our evaluation of many of these devices, we have chosen to utilize a standardized data packet of 64 kilobytes, which we believe serves as a very representative standard. When the total size of the transmission exceeds the amount of data that can be contained in a single packet, the device splits the transmission into multiple packets before sending them or reassembles multiple packages that are received.

In our testing, we have observed networks that seemingly either are not capable of permitting or have been configured so as not to permit data transmissions with a mobile device of more than a certain size, which we have found to be as low as less than 1 MB. Most wireless carriers also appear to limit the amount of time that a mobile device may maintain its data connection, so that a connection will "time out" before its completion.

Devices such as PCs are designed to transmit much larger data packets than the typical mobile device; larger data packets result in faster throughput rates. Our understanding is that many of the tests of network speed that have appeared publicly have been conducted using PCs rather than mobile devices, and often relatively powerful PCs with advanced operating systems. While these tests, as expected, find higher throughput rates than those we cite above, we feel that our method of testing, using mobile devices as configured for the end-user, more accurately measure the performance that the typical wireless customer will experience.

Most importantly for purposes of measuring broadband service, our point is to demonstrate that the device used to obtain these measurements will have a critical effect on the results. Therefore, we suggest that the device, or class of devices, that will serve as the measurement standard be specified in order to obtain the most useful results.

IV. MEASURING SIGNAL QUALITY

In addition to assessing the availability and throughput rate of wireless broadband service, other standards can be applied to measure the quality of wireless service. For example, as part of its testing in the eight markets named above, Root Wireless has determined that the portion of the market receiving good to strong signal quality, as measured by the average signal strength in the areas tested[4], ranged from 84% in New York City to 63% in Washington, DC. In the same testing, we observed data error rates of 4 to 5% in nearly all of the markets.

Including standards such as these in the assessment of wireless broadband service can provide additional useful detail in measuring the true efficacy of that service and should be considered by the Agencies.

V. CONCLUSIONS

Root Wireless applauds the NTIA and RUS efforts to determine where broadband service is available. Wireless service constitutes a critical component of such service, and Root Wireless looks forward to offering an independent evaluation of the availability and quality of wireless broadband service. As the Agencies further refine the definition of broadband service, we would suggest that two overriding issues will greatly influence the outcome of this undertaking and therefore warrant careful consideration at the outset.

[4] Based on signal strength as measured in decibels.

First, as we have attempted to demonstrate, the performance of wireless networks is subject to variability due to a host of factors. In order to permit measurements that are meaningful and offer true comparability for purposes of assessing networks and other services and devices that operate through these networks, it is critical to define fairly specifically the manner in which these variables will be controlled. The appropriate outcome may be to take the best or worst case or an average over time or some other statistically derived measure, or even a combination of the above. Likewise, to control the variability that exists between the devices with which performance can be measured, it would seem advisable to prescribe measurement standards, such as using a class of devices that are based on a common operating standard.

Second, as we have pointed out, actual network performance can be quite different from the performance that might be predicted based simply on models or network standards. Root Wireless would submit that the best measure therefore is one based on the experience enjoyed by the end-user. Analysis of wireless broadband service should be based on observing or replicating that end-user experience in those users' actual locations.

Respectfully submitted,

ROOT WIRELESS, INC.

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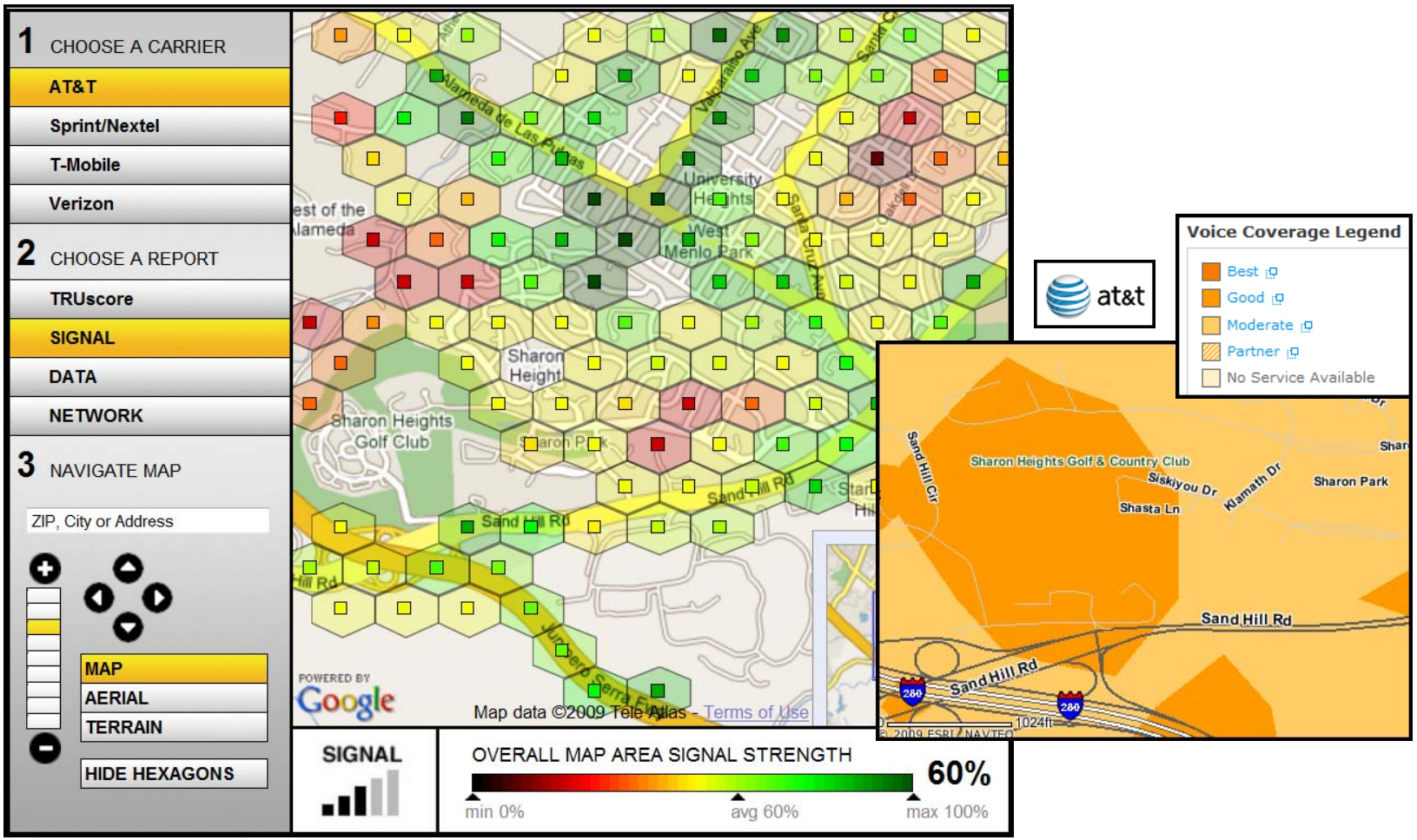
November 30, 2009



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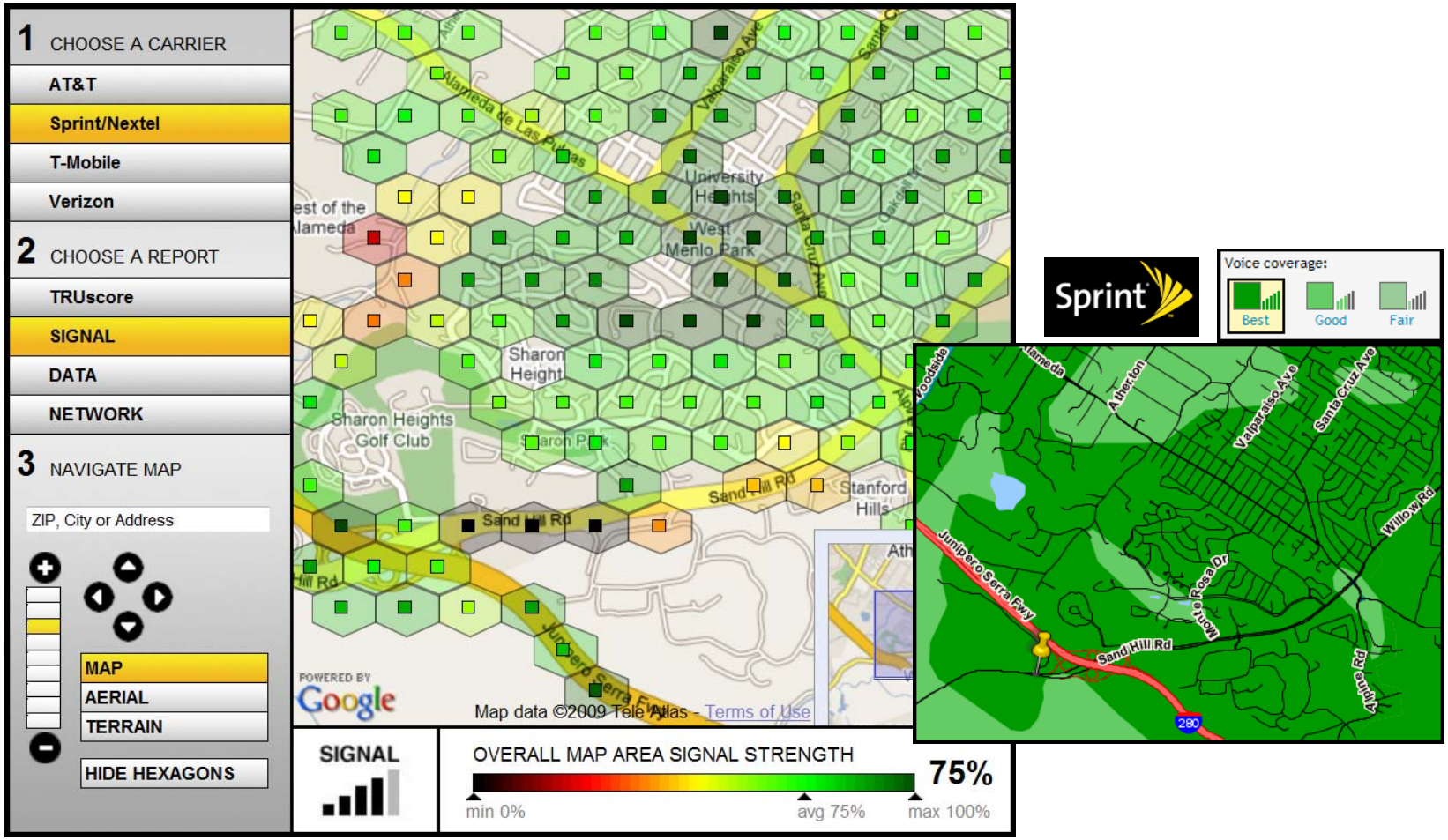

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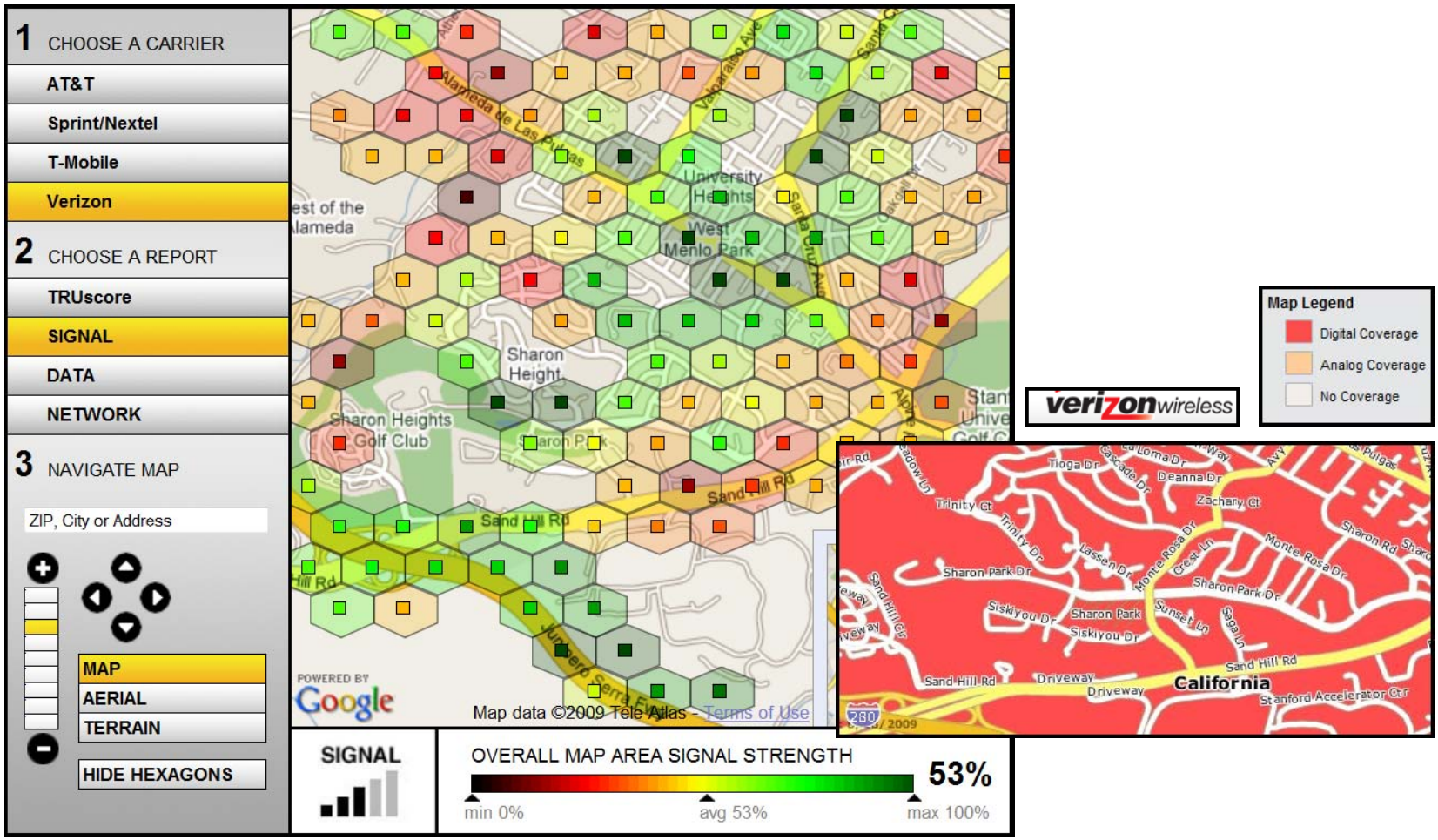

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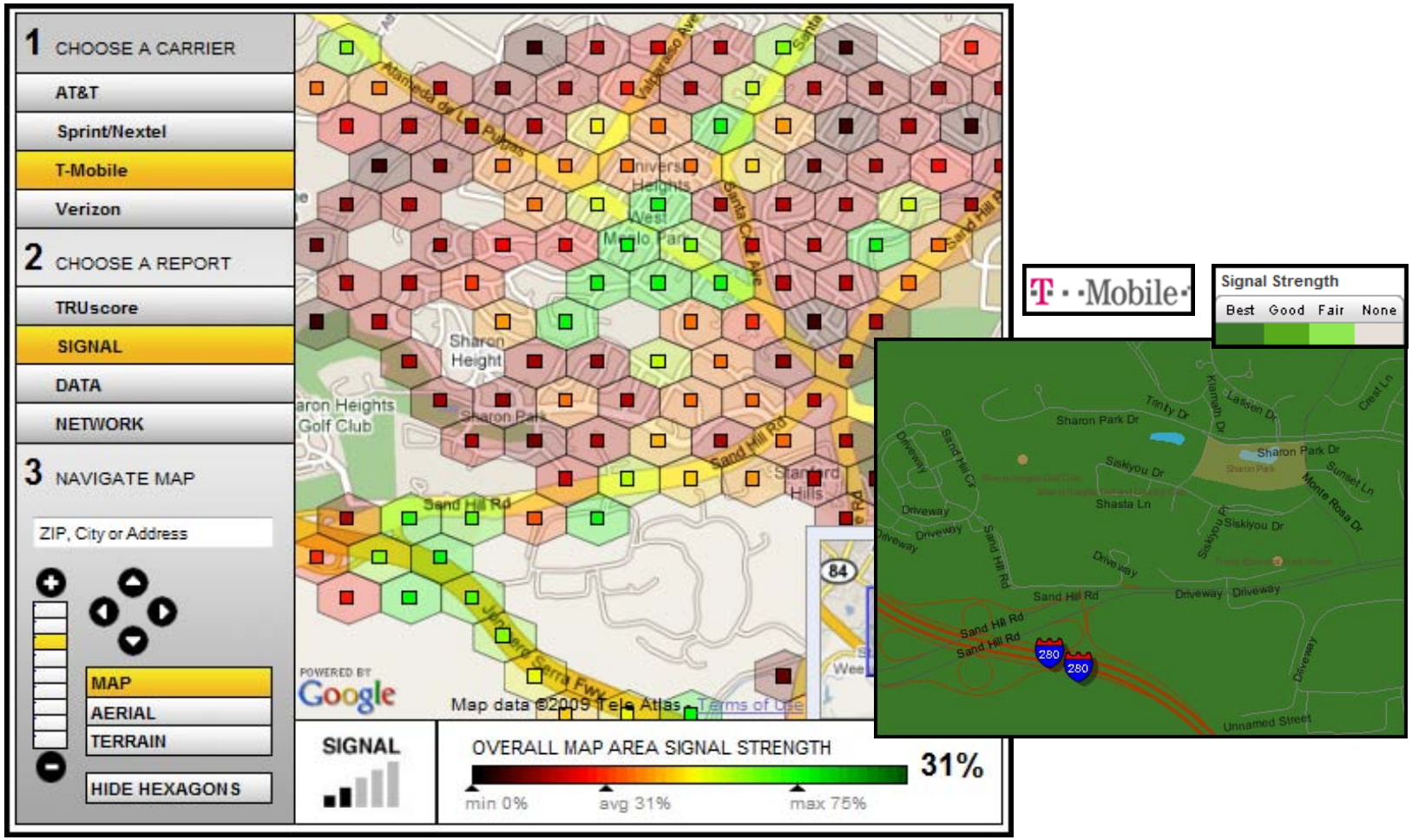

Measuring True Mobile Performance